

## Chapter 10

# Fuzzy Goal Programming With Interval Type-2 for Solving Multi-Objective Sustainable Supplier Selection Problems

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### ABSTRACT

*Supply chain management is going on changing and developing in line with the needs of the growing global supply chain. Performance of supply chain, considered as a whole so that businesses can accommodate these evolvments and change, needs to be improved in the long run. Actually, businesses work with suppliers complying with their policies from past to present. However, other dimensions of sustainability should be considered, as well as economic criteria when selecting suppliers. With the right supplier selection made in this respect, by contributing to the efficient functioning of the supply chain, it will increase customer satisfaction, and therefore, the enterprises will reach the goals they set. The solution of the multi-objective sustainable supplier selection problem has been realized by using the “satisfied optimal supplier design” algorithm, also called fuzzy goal programming, with de novo-based interval type-2 proposed in this study.*

### INTRODUCTION

Biological systems that are developing evolve through a process of change over time as required by the mission of their assets, and they reach the most suitable structure for their structure. In this process, with the effect of environmental conditions, they change through developing in time. This change and development process is an inevitable fact, and organizations in the manufacturing and service sectors try to achieve their goals under some constraints by following similar development processes. Due to the global competition in the present day, businesses should consider synchronously many processes from planning to purchasing, from reaching the customer to after-sales service, and from environment-friendly

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production to the development of social responsibility capability to achieve the maximum benefit on their part. Because of the developing technology, the communication/transportation problem between the countries has been solved, which has made it possible to meet the demands of people in different places in a short time. Therefore, businesses must create an efficient supply chain and manage this chain at an optimum level to have sustainability.

Supply Chain Management (SCM) is integrated management that includes the flow of materials, information, and money that enables the customer to reach the right product at the right time, in the right place, at the right price for the entire supply chain at the lowest possible cost. In other words, it is to create strategies and business models to increase customer satisfaction by integrating the basic business processes in the chain (Uçal Sarı et al., 2017). As a natural result of increased customer satisfaction, it will lead to performance enhancement along the supply chain. In this context, businesses should be more sensitive in establishing a trust relationship throughout the supply chain and pay more attention to establishing a trust relationship with their suppliers and customers in the cooperation process (Cengiz & Aksoy, 2017). SCM has become one of the businesses' chief means of managing costs and improving economic efficiency as they face the highly competitive market these days (Hong et al., 2018). With the concept of sustainability, there has been a change in recent years from considering purely economic and business criteria for the selection of suppliers, to include environmental criteria. It is important to remember that the goal is not and should not be to substitute the economic and business criteria with environmental criteria, but rather to find the environmental criteria together with the economic and business criteria (Rezaei, 2019).

Over the past decade, sustainability in supply chains has gained much attention owing to the tremendous attention provided to economic, social, and corporate responsibility by governments and non-governmental organizations. Thus supply chains are gradually implementing practices of sustainability (Ansari & Qureshi, 2015). Sustainable Supply Chain Management (SSCM) is SCM in a manner that incorporates the sustainability goals and requirements identified by the business, suppliers, customers, and external stakeholders (e.g., consumers, policymakers, associations). Such sustainability goals include economic, social, environmental, and ethical goals which all supply chain members must achieve to make the supply chain sustainable (Fritz, 2019). Sustainable supply chain activities not only have a beneficial impact on the natural environment and community but also result in long-term economic benefits and strategic benefits across the entire chain (Masoumik et al., 2014). In sustainable supply chains, while competitiveness is required to be preserved by meeting consumer needs and related economic criteria, members must meet environmental and social criteria to stay within the supply chain (Seuring & Müller, 2008). The SCM sector has an inherent connection to sustainability, and it has been recognized that the idea of sustainability applies to both the organizational drivers of productivity and their relationship with the people and the world in which we all live. This natural connection provides exciting opportunities to supply chain researchers through their work to create a profound societal difference. As the principles and theories relating to sustainable supply chains continue to evolve, future-oriented strategies should be developed (Winter & Knemeyer, 2013).

## **Overview of Sustainable Supply Chain Management**

With the “Triple Bottom Line” approach created by Elkington (1994), SSCM pays equal attention to the three dimensions of sustainability. Sustainability has been defined across various terms and methods by industry and literature. The common theme emerging from the various concepts of sustainability

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